KSC SPACE STATION OPERATIONS LANGUAGE (SSOL)

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4-18-85

Space Station Operations Language, Synopsis:

The Space Station Operations Language (SSOL) will serve a large community of diverse users dealing with the integration and checkout of Space Station modules. This briefing presents KSC's comprehensive plan to achieve Level A specification of the SSOL system, encompassing both the language and its automated support environment.

The SSOL concept has been formulated to improve integration and test processing in the Space Station era. The concept is not composed of a single element, restricted to language alone, but a collection of fundamental elements that span languages, operating systems, software development, software tools and several user classes.

The following approach outlines a thorough process that combines the benefits of rapid prototyping with a coordinated requirements gathering effort. The end result will be a Level A specification of the SSOL requirements.

KSC SPACE STATION OPERATIONS LANGUAGE (SSOL) ACTIVITIES

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4-18-85

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- **BACKGROUND:** THE CURRENT KSC INTEGRATION, TEST AND LAUNCH SYSTEMS FOR **SHUTTLE** ARE CUSTOM SOFTWARE DESIGNS, PREDOMINATELY ASSEMBLY LANGUAGE CODING AND REFLECT AN INVESTMENT TOTALING HUNDREDS OF MAN-YEARS.

- **PROBLEM:** THIS CUSTOM SYSTEM CONCEPT, COUPLED WITH DATED LAUNCH PROCESSING HARDWARE (CIRCA 1975), SEVERELY RESTRICTS THE APPLICATION OF TECHNOLOGICAL ADVANCES THAT COULD PRODUCE A LONG TERM COST SAVINGS OR ADDED DATA SYSTEM CAPABILITY.

IN THIS ENVIRONMENT, IT IS VERY DIFFICULT TO USE "OFF-THE-SHELF" HARDWARE (CPU'S), OPERATING SYSTEMS, DRIVERS, SHELLS, COMPILERS, AND IN SOME CASES, DEVELOPMENT TOOLS. PORTABILITY OF SYSTEM OR USER APPLICATION SOFTWARE IS RARE.

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o **CHALLENGE:** TO DECREASE THE SPACE STATION INTEGRATION AND TEST SOFTWARE LIFE-CYCLE COST WHILE PROVIDING TECHNOLOGICAL TRANSPARENCY AND INCREASED I&T PROCESSING EFFICIENCY. THIS WOULD INCLUDE:

- CAPITALIZING ON THE COMMONALTY OF PROCESSING NEEDS (AND LANGUAGES) AT THE DEVELOPMENT, INTEGRATION AND LAUNCH SITES.
- IDENTIFYING AND USING STANDARDS IN SSOL INTERFACES, SUPPORT ENVIRONMENTS, DEVELOPMENT TOOLS AND LAYERS.
- FACILITATING TECHNOLOGICAL TRANSPARENCY BY PROMOTING THE THE USE OF MACHINE INDEPENDENT SOFTWARE AND HARDWARE IMPLEMENTATIONS.
- DEFINING EARLY SOFTWARE PORTABILITY GOALS FOR: USER APPLICATIONS, REAL TIME OPERATING SYSTEM S/W, LANGUAGE EXECUTORS AND DEVELOPMENT TOOLS

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- **SSOL DEFINITION:** A USER ORIENTED SPACE STATION OPERATIONS LANGUAGE THAT IS:
  - NEAR ENGLISH-LIKE AND SELF DOCUMENTING
  - RELATIVELY TEST ARTICLE, INTERPRETER AND DATA BASE INDEPENDENT
  - EXECUTABLE IN A REAL-TIME ENVIRONMENT AND CONTROLS USER INTEGRATION AND TEST PROCESSES
  - AN EVOLUTION OF EARLIER, HIGH ORDER, PROCESS CONTROL LANGUAGES

- **SSOL SUPPORT ENVIRONMENT:** (KSC APPLICATION) THE NECESSARY ON-LINE AND OFF-LINE SOFTWARE SUPPORT ENVIRONMENT THAT FACILITATES SSOL LANGUAGE EXECUTION. INCLUDES THE OPERATING SYSTEM (NUCLEUS AND OS SUPPORT SOFTWARE), COMPILERS, EXECUTORS, CONFIGURATORS, SYSTEM-BUILD TOOLS, AND CONFIGURATION MANAGEMENT TOOLS.

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- **NASA BENEFITS:** NASA WILL BENEFIT IN SPACE STATION INTEGRATION AND TEST PRODUCTIVITY IMPROVEMENTS BY THE REASONABLE APPLICATION OF SSOL CONCEPTS.

THE GOALS ARE:

- SIMPLER OPERATION AND DECREASED LIFE-CYCLE SOFTWARE COSTS
- REDUCTIONS IN THE REQUIRED DEGREE OF SPECIALIZATION IN HARDWARE, SOFTWARE, AND PEOPLE.
- BETTER LONG-TERM USE OF TECHNOLOGY, REDUCING NASA'S ONE-TIME DEVELOPMENT OR RE-HOSTING COSTS.
- GREATER REPEATABILITY OF I&T TEST ACTIVITIES BY THE USE OF TRANSPORTABLE USER APPLICATION PROGRAMS THAT FOLLOW THE TEST ARTICLE

0 **RELATED R&D EFFORTS:**

- JSC LEVEL C: SDE DEVELOPMENT, ON-BOARD SYSTEMS DEVELOPMENT INCLUDING THE EXECUTION OF HIGH ORDER LANGUAGES, UIL, AND I/F TO GROUND SYSTEMS
- GSFC: USER INTERFACE LANGUAGE DEVELOPMENT (UIL), STOL, TAE, PAYLOAD OPERATIONS SUPPORT
- UNIVERSITY OF COLORADO: USER INTERFACE LANGUAGE, PROCESS CONTROL TECHNIQUES.
- SSDS ARCHITECTURAL STUDY CONTRACTORS: SDE, SOFTWARE DEVELOPMENT, SYSTEM STANDARDS AND TOOLS
- VARIOUS GROUPS IN AI, EXPERT SYSTEMS, ADA AND MAN-MACHINE INTERFACES.

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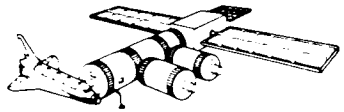
- **KSC/SSOL TECHNICAL APPROACH:**

  1. TO DEVELOP, DOCUMENT AND DEMONSTRATE A VIABLE SSOL LANGUAGE AND S/W SUPPORT ENVIRONMENT CONCEPT.
  2. TO DEFINE A PROCESS FOR TECHNICAL INVOLVEMENT WITH KEY CENTERS, USERS AND DEVELOPERS WITHIN THE INTEGRATION AND TEST COMMUNITY.
  3. TO PRODUCE A COORDINATED SSOL LEVEL A SPECIFICATION TO JSC LEVEL C.
  4. TO VALIDATE AND REFINE THE CONCEPT IN A VAX-BASED R&D LABORATORY SETTING THAT FACILITATES TECHNICAL INFORMATION EXCHANGE.

- **THE SSOL CONCEPT FOCUSES ON:**
  - PORTABILITY OF SYSTEM AND USER S/W WHERE FEASIBLE
  - OPTIMAL USE OF COMMERCIAL S/W
  - PROMOTION OF SYSTEM AND DEVELOPMENT S/W STANDARDS
  - SUPPORT OF AN INTERPRETIVE EXECUTION MODE
  - EXTENSIVE USE OF DATA BASES FOR: LANGUAGE INTERPRETATION, TEST ARTICLE DEFINITION, OFF-LINE PROCESSES
  - INCLUSION OF SELECTED NEW TECHNOLOGY ADVANCES IN: AI, LANGUAGE DEVELOPMENT, TOOLS, AUTOMATION, GRAPHICS, WINDOWS AND ICONS

KSC SPACE STATION



FUTURE PROJECTS TECHNOLOGY

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THE SSOL CONCEPT:

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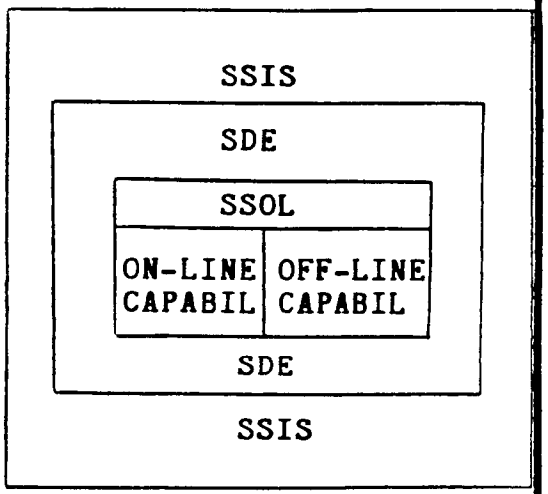
- **SSOL ENVIRONMENT AND INTERFACES:**

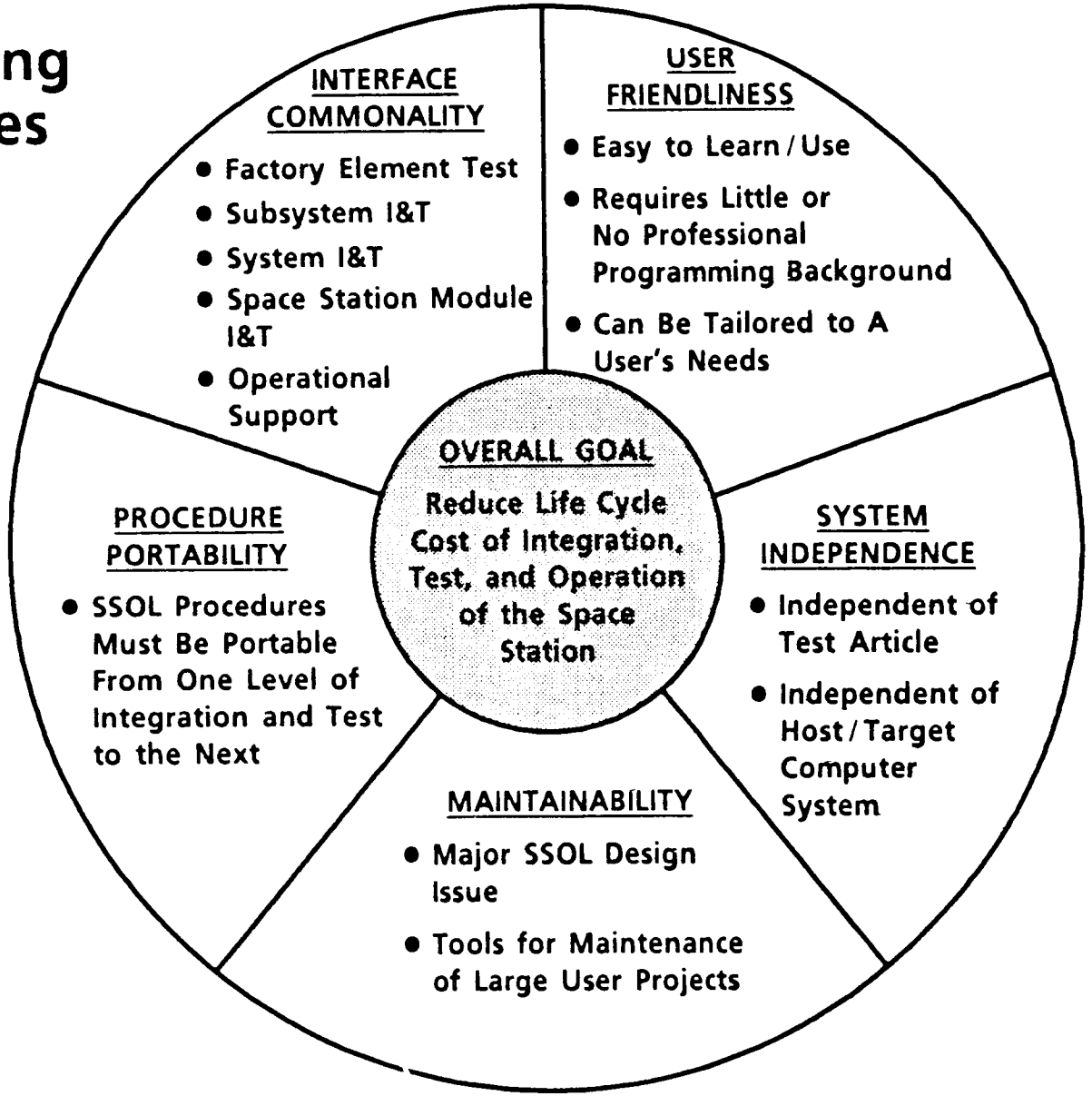
KSC TASKS:

- DEFINE USER REQUIREMENTS
- DEFINE SSOL FUNCTIONAL REQUIREMENTS
- DEFINE NON-SSOL FUNCTIONAL REQUIREMENTS
- DEFINE ON-LINE CAPABILITIES
- DEFINE OFF-LINE CAPABILITIES

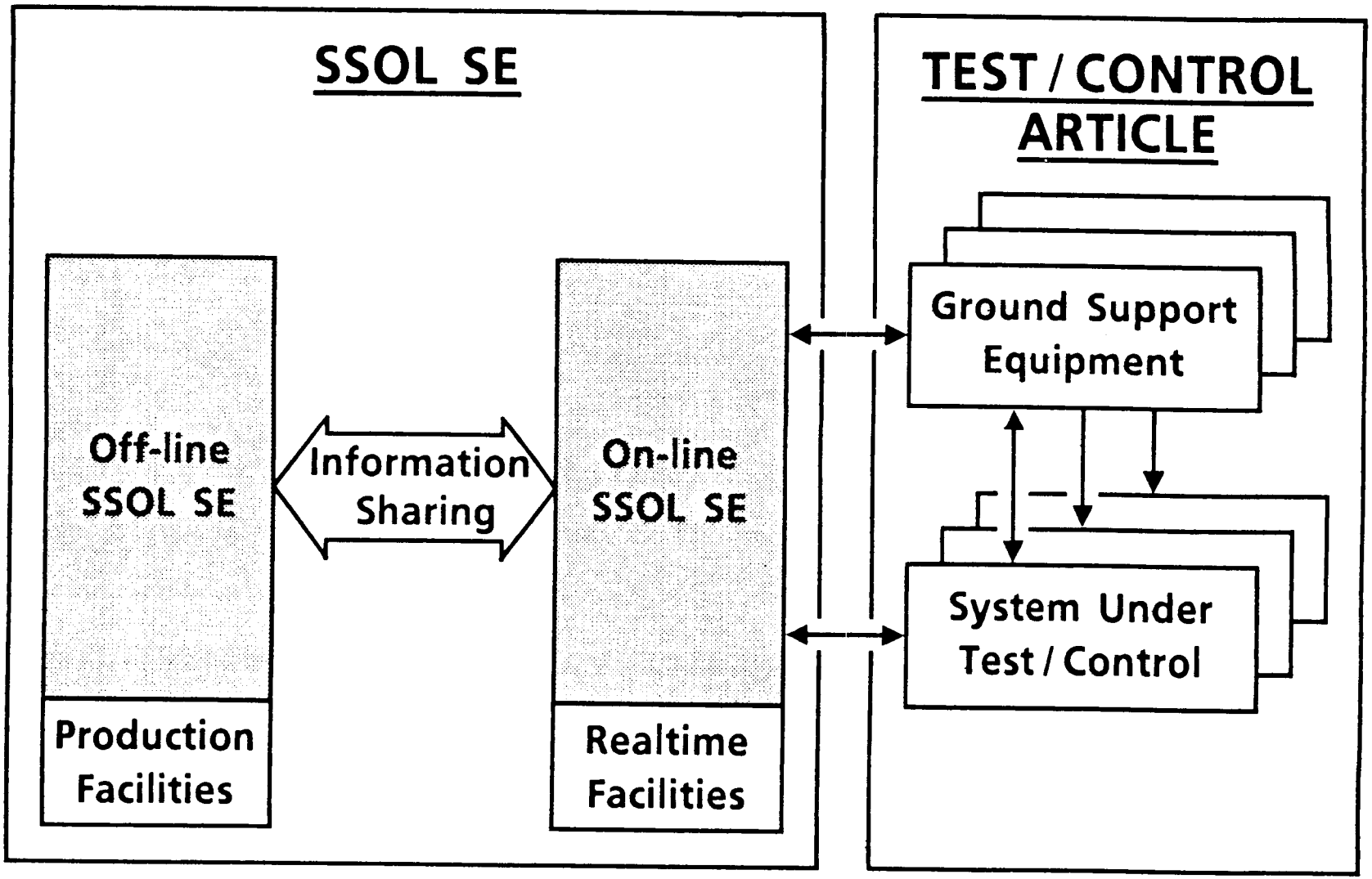


Architectural Goals and Objectives

- **Supporting Objectives**

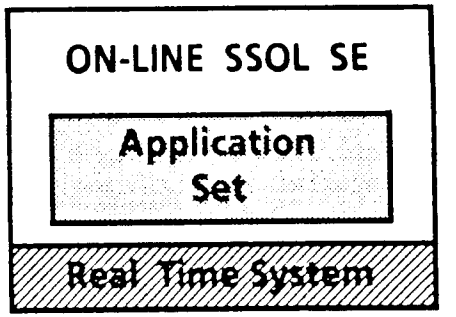


Top Level View of SSOL SE

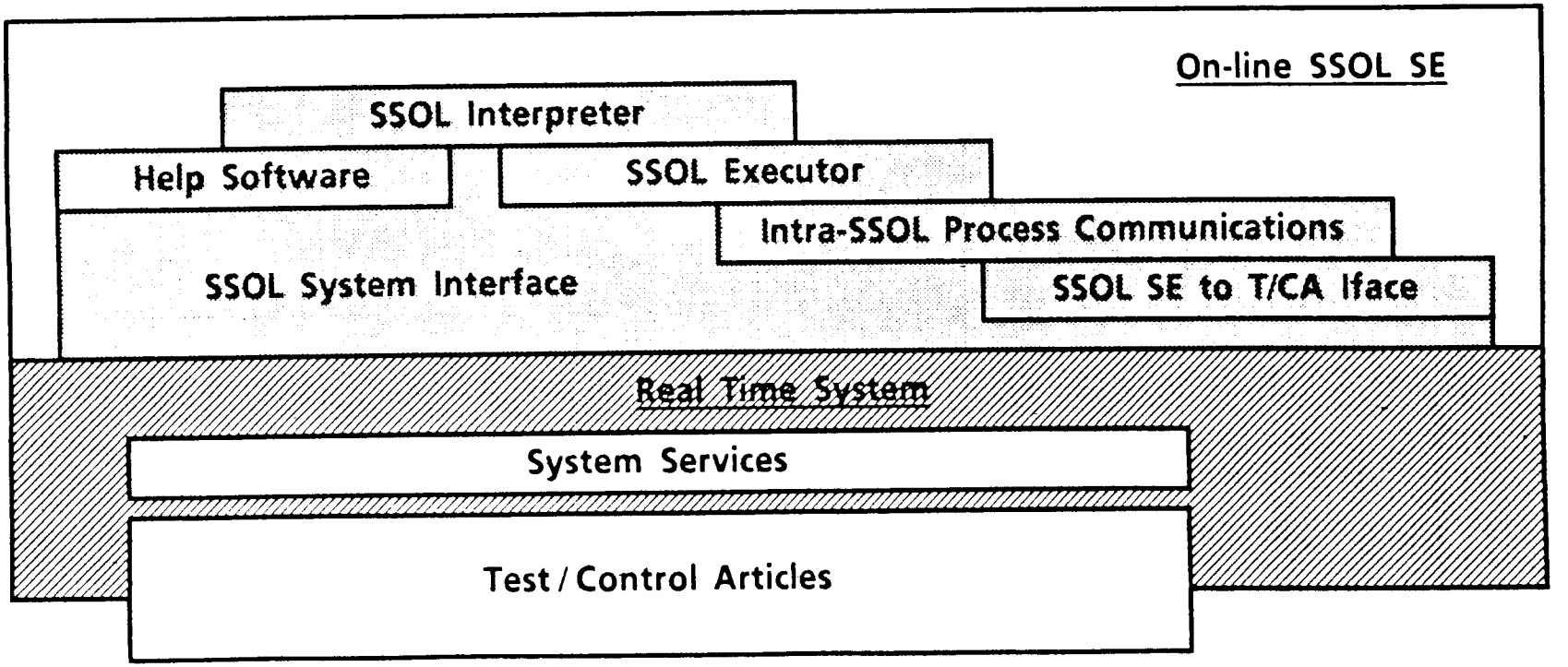


Overview of On-line SSOL SE

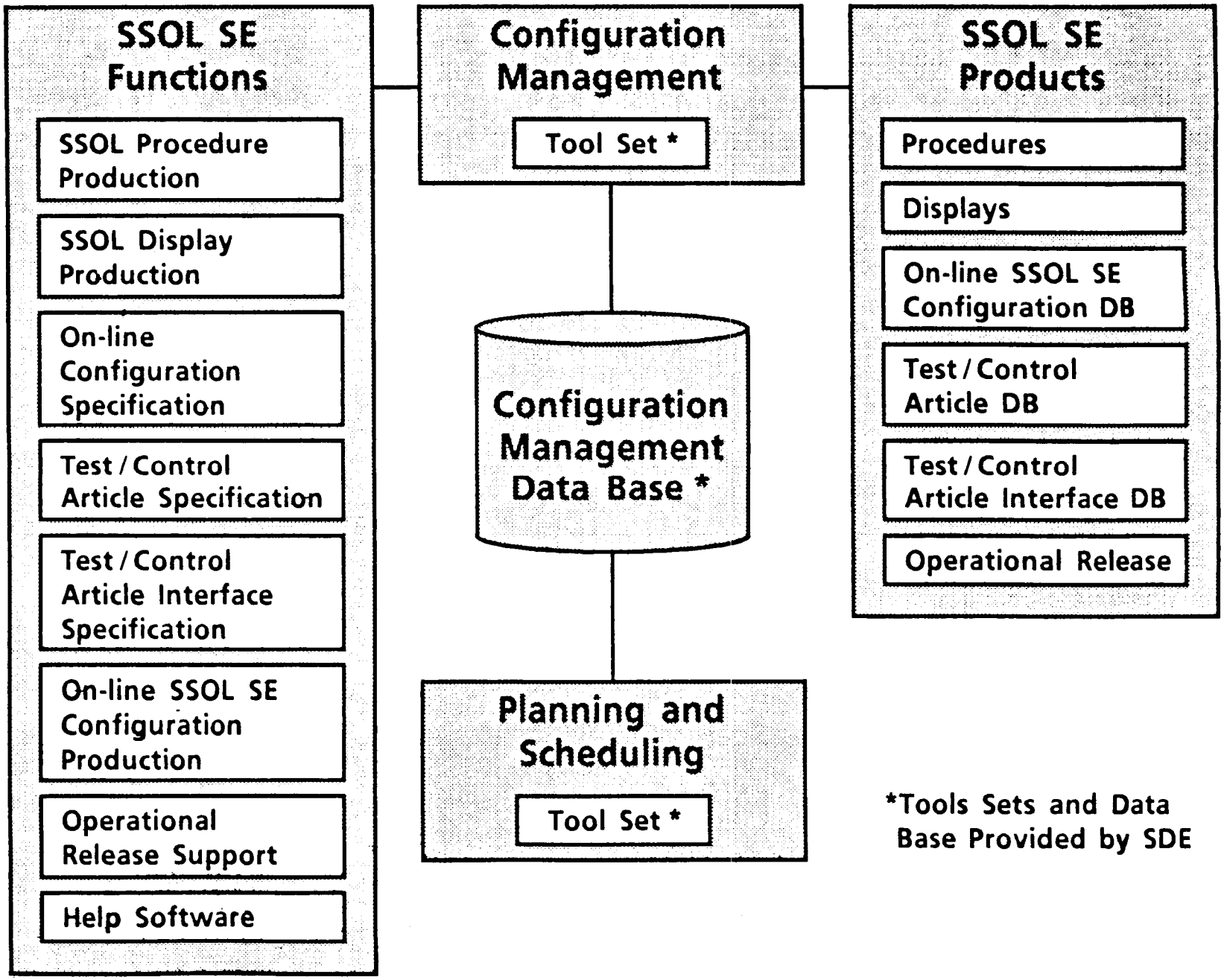
- Overall Organization:
  An Integrated Set of Application Programs



- Major Components and Relationships:



Overview of Off-line SSOL SE



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THE SSOL DEFINITION PROCESS:

Documentation and End Products (KSC)

• SSOL Technical and Project Control Documentation

Planning Documentation

- POP Inputs
- KSC SSOL Plan
- Tri-Center Planning Package

Requirements and Conceptual Design Definition Documentation

- SSOL Requirements for I&T Community
- Integrated SSOL Requirements
- Assessments and Trades Report
- SSOL Level A Specification

SSOL Concept Evaluation Documentation and Products

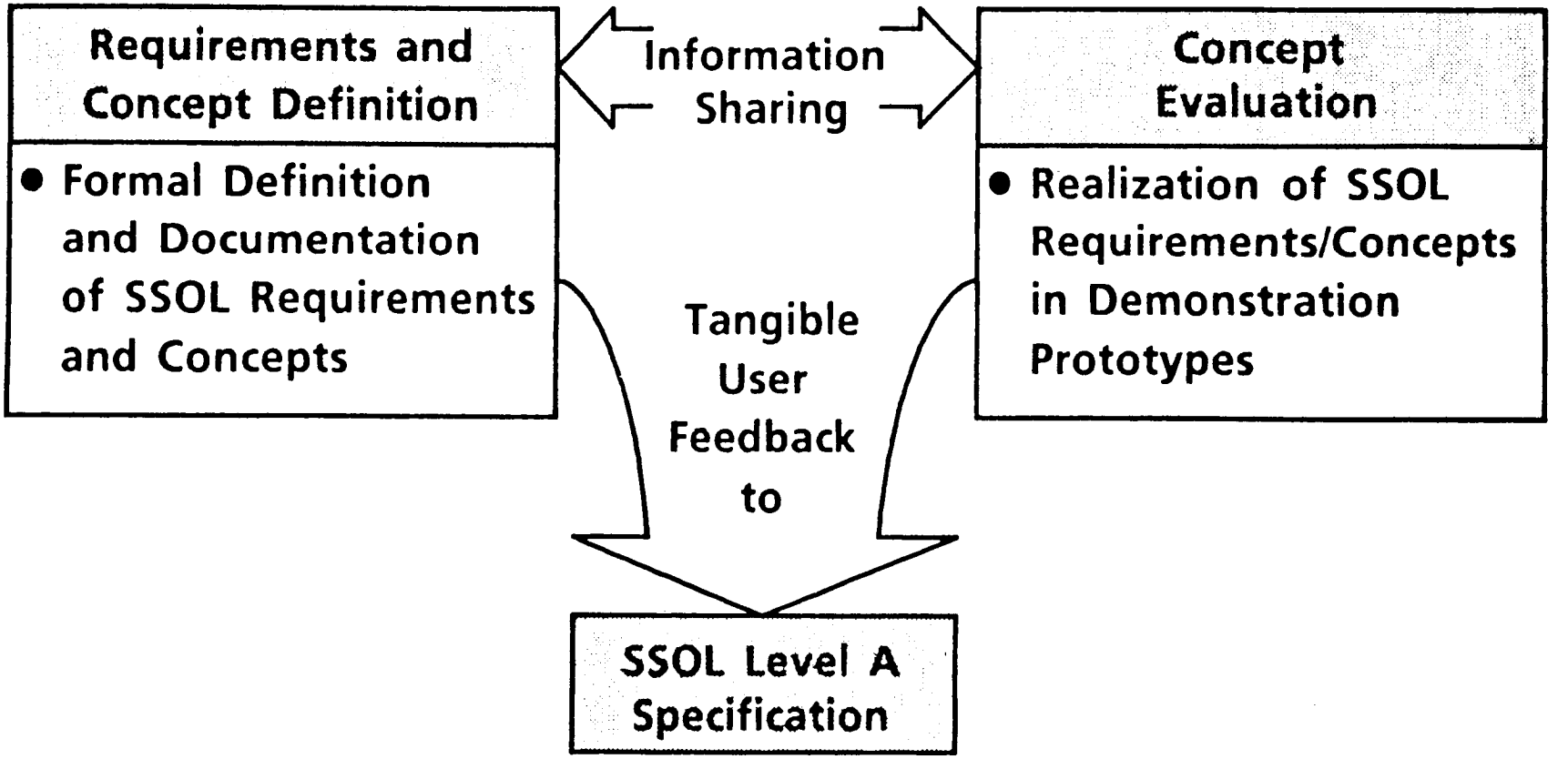
- Rapid Prototype Demonstrations
- Concept Evaluation Reports (2)

Internal KSC Documentation

- Working Papers
- Prototype Design Documentation
- Demonstration Scenarios
- T&E Reports
- Periodic Change Recommendations

KSC Approach

- Provides Concrete Evaluation, Validation, and Refinement of SSOL Requirements/Concepts



- Initial KSC Focus on Needs of I&T Community

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THE SSOL DEVELOPMENT LABORATORY:

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- **SSOL DEVELOPMENT LABORATORY:**

  - VAX 11/780 BASED
  - TWENTY-TWO MEMBER TEAM. JOINT CIVIL SERVICE AND CONTRACTOR.
  - EMPLOYS RAPID PROTOTYPING: REQUIREMENTS-PROTOTYPE-DEMONSTRATE-UPDATE LOOP
  - SOFTWARE INCLUDES:

    OPERATING SYSTEM (DEC VMS)

    DATA BASE (DATATRIEVE)

    LANGUAGE DEVELOPMENT S/W (TWS)

    GRAPHICS DEVELOPMENT S/W (PRECISION VISUALS AND DEC)

    MODELING SOFTWARE (ASPEN)

    EMULATION SOFTWARE (POLYGON-240)

    UNIX

    PASCAL

    ADA

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- **ACCOMPLISHMENTS:**

  - CONCEPT DEVELOPMENT AND REQUIREMENT TEAMS ESTABLISHED
  - KSC USER TEAM ESTABLISHED
  - SSOL DEVELOPMENT LABORATORY ESTABLISHED
  - DOCUMENTATION UNDERWAY: (NOT A COMPLETE LIST)

DOCUMENT:	STATUS:
KSC SSOL REQMTS. AND CONCEPT EVAL. PLAN	COMPLETE
TRI-CENTER PLAN	IN REVIEW
SSOL CONCEPT DOCUMENT	DRAFTED
SSOL SYSTEM REQUIREMENTS	IN WORK
SSOL PROTOTYPE DEFINITION DOCUMENT	IN REVIEW

Schedule